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WHY ENERGY PRICES SHOULD BE DEREGULATED

A REPORT

PREPARED FOR THE USE OF THE

SUBCOMMITTEE ON ENERGY AND POWER,
COMMITTEE ON
INTERSTATE AND FOREIGN COMMERCE
UNITED STATES HOUSE OF REPRESENTATIVES

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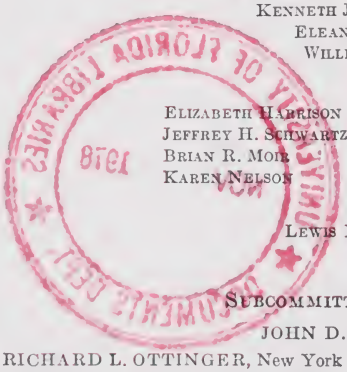

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LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND POWER,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
Washington, D.C., October 18, 1978.

Hon. HARLEY O. STAGGERS,
Chairman, Committee on Interstate and Foreign Commerce,
U.S. House of Representatives,
Rayburn House Office Building,
Washington, D.C.

DEAR MR. CHAIRMAN: Professor Kenneth E. F. Watt, who has served as a consultant to this committee in the past, has produced a provocative paper entitled "Why Energy Prices Should Be Deregulated", a copy of which is enclosed.

Dr. Watt's central thesis is that high energy prices act to the advantage of the lower income segments of society. The correctness of this conclusion is not immediately apparent, and the thesis itself is the subject of considerable debate. I will say frankly that I find aspects of this troubling but, at the same time, I believe that the issue is one which we must address directly.

It is in this light that I recommend Dr. Watt's paper be reprinted as a committee print and given wide distribution. It is my intention to convene hearings of the Subcommittee on Energy and Power at a later date to examine the questions Dr. Watt discusses in his paper. Publication of this paper should assist in our efforts.

Sincerely,

JOHN D. DINGELL, *Chairman.*

Enclosure.

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Why Energy Prices Should be Deregulated

(Kenneth E. F. Watt)[1]

Given constant increases in the real cost of producing petroleum and natural gas in the United States, it is clearly an injustice to domestic energy producers for the government to impose an arbitrary ceiling on the prices they can receive. The conventional political justification for this price regulation is that without it, there would be a deleterious impact on a large number of political constituencies, including labor, consumers, the poor and the middle classes. The standard argument offered is that since energy is an input to the manufacture of a wide array of goods, any increase in the price of energy would ultimately be reflected in an increase in the retail prices of all those goods. Consequently, the consumer price index would rise, consumer purchasing power would drop, and there would be a decline in the standard of living for Americans.

This argument is based on an extremely simplistic view of the workings of the U.S. economy. Hereinafter it will be demonstrated that the conventional political rationale for low energy prices is simply false; in fact there are six different arguments as to why cheap energy penalizes the very constituencies it is supposed to protect.

The conventional argument overlooks the various types of adjustments to cheap energy that occur in the U.S. economy and in the linkage of the U.S. economy to other economies through the international trade and international monetary systems. Figure 1 illustrates some of the causal pathways that will be discussed, and serves as a backdrop and introduction to the first three arguments for higher energy prices. This flow chart by itself is clearly only a complex hypothesis as to how part of the system responds to energy prices; however, data can be found which demonstrate the existence of all the postulated causal pathways in this chart. Low U.S. energy prices discourage domestic energy production (causal pathway 1) but encourage consumption (2). These two phenomena jointly produce a shortfall in the U.S. energy production relative to demand (3, 4) which in turn stimulates energy importation (5). However, as energy importation increases, this stimulates the export of other commodities, particularly wheat, corn, soybeans, textiles, wood and raw metal, in order to balance U.S. trade with other countries (6). But the extent to which U.S. commodity exports can be increased depends on both the U.S. stocks of commodities available for export (13) and the stocks of commodities in other countries (9). Many factors determine the size of these variables, in turn, but important system determinants are

[1] Kenneth Watt is a professor of zoology, and of environmental studies, and research systems analyst in the Institute of Ecology, at the University of California, Davis; of course, all positions expressed in this article are his alone.

crop-growing weather in other countries (8) and in the United States (10), the acreage of crops planted in the United States (11), and technology inputs to U.S. agriculture (12). Years when crop-growing weather is favorable, on average, outside the United States, world demand for U.S. crops will not be great enough for us to balance up our international trade (14). Thus, when U.S. energy prices are low, but also foreign demand for our crops is low, the U.S. trade deficit will be large (7). This causes U.S. money to accumulate in foreign banks at a rate in excess of the rate of demand for it (20), and the dollar drops in value relative to other currencies (21). This in turn increases the prices of foreign goods in the United States, and that has two bad effects: the U.S. inflation rate is increased (25) but also, sales of foreign goods in the United States weaken (27).

This ultimately leads to a decrease in the rate of growth in foreign economies (28), which still further decreases their purchases of U.S. manufactured goods (29) which are already at a competitive disadvantage because of the high cost of our labor, and the unsuitability of some of our products for foreign market (e.g., large, energy-inefficient cars). This, in turn, slows down the rate of growth in the U.S. economy (30). But if U.S. energy prices are low, so that in some years our agricultural commodity exports are very large, but in other years good crop-growing weather elsewhere decreases foreign demand for our crops, this leads to a massive overhang of U.S. commodity stocks over domestic demand (17). This drops the price of commodities (19), farmers' earnings are lower than their costs (23) and there is a depression in the farm sector which spills out to the rest of the economy if it persists (22). However, if crop-growing weather in other countries is bad, there is a tremendous drawdown in U.S. commodity stocks because of massive exports (17), the domestic commodities prices rise (19) and this can trip an inflation (24).

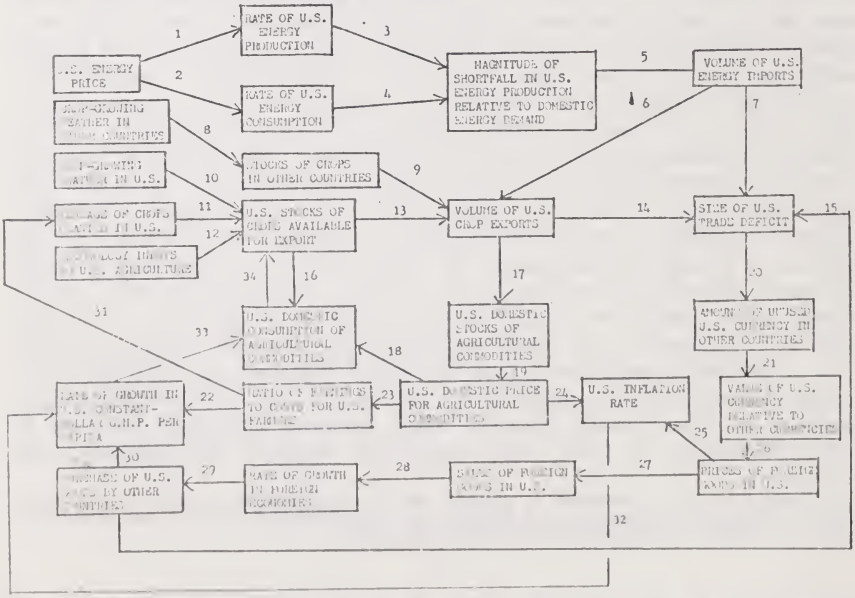


FIGURE 1.—Flow chart illustrating some of the effects of U.S. energy prices on the U.S. economy operating throughout the international trade and monetary systems.

This chart brings out two most curious consequences of low energy prices in the United States. They always have an inflationary effect. If our crop exports are large, inflation is affected by increased food costs (24). If crop exports are small, the inflationary impact comes from increased prices of foreign goods in the United States (25). These are only two of the inflationary impacts of cheap U.S. energy prices. Others are found in other flow charts. Jay Forrester of M.I.T. has pointed out that complex systems often behave in a "counter-intuitive" fashion because it is difficult for the human mind to visualize the ultimate consequences of long chain causal pathways.

The other curious phenomenon revealed by this flow chart is that cheap U.S. energy prices render the economy remarkably sensitive to a number of phenomena produced by crop-growing weather in major prospective consumers of U.S. food, particularly Russia and China. This is particularly significant, because crop-growing weather in some other countries, and hence, crop production is much more volatile from year to year than in the United States. Thus, by keeping energy prices low in the United States, we create the surprising situation in which short-term fluctuations in the economy are made extraordinarily sensitive to a powerful and violently fluctuating destabilizing force: crop growing weather in countries with unstable crop growing weather. Much of the surprising behavior of the U.S. economy since we began importing vast quantities of crude oil is traceable to this situation.

With this flowchart as a backdrop, we now consider six arguments against low energy prices, using illustrative data from standard U.S. Government statistical sources.

Argument 1: The impact of cheap energy on the purchasing power of the poor and the middle classes. Elementary common sense tells us that if the price of energy is kept artificially low by the Government, this will encourage Americans to use it, but also discourage domestic producers from producing it. Thus, low domestic energy prices simply result in a discrepancy between production and consumption, which gradually increases as the purchasing power of Americans increases relative to the retail price of energy. This shortfall is met by gradually increasing petroleum imports. But a country is like a family: on balance, over time, it must sell goods and services at roughly the rate at which it buys goods and services. Therefore, as the United States has increased its imports of petroleum, it has had to increase its exports of other items to raise the money needed to pay for the oil. The reason for the economic and political problems related to petroleum pricing is that few Americans inside or outside Government grasp the full implications of the massive export required to pay for the imported oil.

Table 1 reveals the impact that increasing crude oil imports have had on the U.S. balance of trade with other countries, and shows how various categories of U.S. exports to other countries have increased to compensate for this increasing importation from O.P.E.C. countries. The table brings out two key facts. First, the increase in the cost of oil imports from 1970 to 1976 has been very great: about $28.3 billion dollars. The other fact is less well known. Most people, thinking of the United States as a major manufacturing nation, would expect this increase in imports of crude oil to be paid for largely by increase in exports of manufactured products. This assumption is based on a lack of awareness of the intensity of the competition the United States now faces in world markets from West Germany,

Japan, and other manufacturing nations. Thus, we see in the table that only about $9 billion of the increased fuel costs could be covered by an increase in exports of all manufactured goods and chemicals. In fact, over $10 billion of the increase in fuel import costs was paid for by an increase in U.S. exports of just a few raw commodities, particularly wheat, corn and soybeans. But there has also been a great increase in net exports of a wide variety of other raw commodities from the United States: Textiles, wood and metal ores and scrap. Too little attention has been given to the consequences for the U.S. economy of all these massive, and gradually rising exports. In fact, as figure 2 shows, the consequences are remarkably pervasive throughout the economy. They include food prices, land prices, and effects on city densities and the relative economic attractiveness of various types of transportation systems.

It is interesting to track the impact of massive crude oil imports through the economic system so as to reveal the way in which these affect the standard of living of the typical American family. Using nothing but routinely-published Government statistics, we do this in table 2. As the real price of drilling for U.S. crude oil (price corrected for inflation) increased, it became increasingly uneconomic, in the face of Government price regulation, to supply the U.S. market with domestic crude oil. Consequently, the U.S. oil market was increasingly supplied with foreign, as opposed to domestic crude oil. Consequently, the U.S. oil market was increasingly supplied with foreign, as opposed to domestic crude oil (third column). One of the means used to pay for this was wheat exports, which accordingly rose (fourth column) in years when other countries had major crop production shortfalls. This meant that in the years following 1972, great increases in crude oil resulted in a drawdown of U.S. domestic stocks of commodities, as illustrated by the wheat stocks statistics in column five. This was because between 44 and 73 percent of the wheat being grown each year in the United States was being exported to pay for imported crude oil. Consequnetly, years when there was a particularly heavy export of wheat, as between 1972 and 1975, there was a great increase in the price of wheat. Thus, from 1972 to 1974, the price of wheat per bushel increased by 2.32 times. This, in turn, translated into a higher U.S. food cost for the typical family (last column). Where food had only taken 39 percent of the average family spendable earnings in 1972, it took 47 percent in 1974. In short, "cheap energy" is an illusion. By keeping the cost of domestic crude oil down, the Government simply plays the cruelest type of political hoax on the electorate. Energy becomes more costly than it would have been if the price had been deregulated, but the family pays for energy everywhere except at the pump island. The same phenomenon as revealed for food costs in this table is found for housing and clothing.

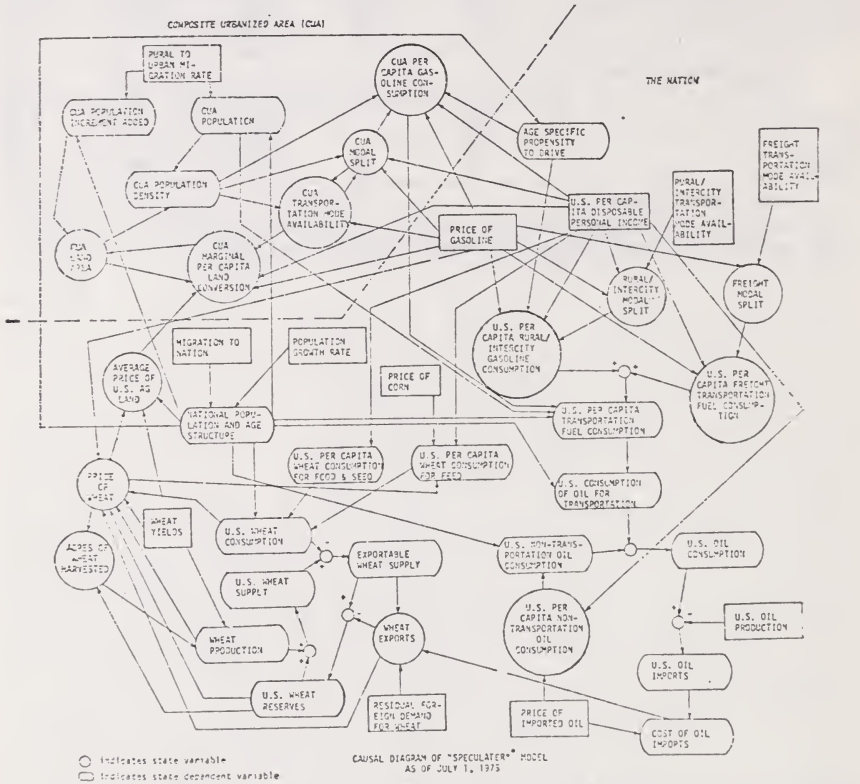
TABLE 1.—RELATIVE ROLES OF MANUFACTURED PRODUCTS AND RAW MATERIALS IN MAINTAINING THE U.S. TRADE BALANCE IN THE FACE OF MASSIVE INCREASES IN CRUDE OIL IMPORTS

[All amounts in billions of dollars]

Item	Value of—				Increase (+) or decrease (−) in net U.S. trade balance, 1970 to 1976
	1970 U.S. exports	1970 U.S. imports	1976 U.S. exports	1976 U.S. imports	
Mineral fuels and related materials	1.595	3.075	4.226	33.996	−28.291
Machinery and transportation equipment	17.882	11.172	49.510	29.824	12.976
Other manufactured goods	7.636	13.285	17.777	30.179	−6.753
Chemicals	3.826	1.450	9.958	4.772	2.810
Subtotal, manufactured goods and chemicals					9.033
Wheat and flour	1.112	----------	4.041	----------	2.929
Corn	.824	----------	5.223	----------	4.399
Soybeans	1.216	----------	3.315	----------	2.099
Textiles	.543	.202	1.426	.249	.836
Subtotal, renewable resources					10.263

Note: Data from tables 1478 and 1479, Statistical Abstracts of the United States for 1977

FIGURE 2.—Flow chart illustrating the systemic effects of massive raw commodities exports on the U.S. economy. In the chart, wheat is used as a surrogate variable to represent the kinds of effects introduced by increasing exports of a wide range of commodities, including corn, soybeans, rice, wood products and textiles. This type of chart not only can be used to explain the causal pathways in the system; it can also be used as the basis for building computer models to mimic the consequences of low energy prices on the economy. This chart illustrates only one of a variety of classes of effects of low energy prices; other parts of the model mimic the effects on unemployment and crime rates, pollution, investment, taxation and economic growth rates, etc.



Earlier versions of the SPECULATER causal diagram may be found in:

- K. Watt et al, "A Simulation of the Use of Land and Energy at the National Level" in SIMULATION, May 1975.
- J. Young et al, "A Simulation Program Examining the Causalities Underlying Land, Agriculture, Transportation and Energy Relationships" presented to the International Congress of Systems and Cybernetics, Bucharest, Romania, August 25-29, 1975.

TABLE 2.—IMPACT OF GOVERNMENT ENERGY PRICE REGULATION ON THE PURCHASING POWER OF THE TYPICAL FAMILY

Year	Average cost per foot to drill for oil and gas in the United States (1972 dollars)	Value of imported petroleum products (billions of dollars)	Wheat exports from United States (millions of bushels)	U.S. stocks of wheat, June 1 (millions of bushels)	Average weekly food cost as a percentage of average spendable weekly earnings
1965	18.09	2.09	852	921	43
1970	20.61	2.76	741	982	41
1972	20.76	4.30	1,135	983	39
1973	21.27	7.61	1,217	597	45
1974	24.85	24.29	1,019	340	47
1975	29.06	24.81	1,173	435	46
1976		31.79	950	664	43

However, while the trend in food, clothing and housing is for these budget items to take a progressively larger percentage of average spendable weekly earnings, that trend is obscured by deviations about the trend produced by variations in crop-growing weather in countries that are prospective customers for U.S. commodities. Thus, it will be noted that the percentage of spendable earnings taken by food declined from 1974 to 1975, and again to 1976.

Table 3 gives more understanding as to why there should be fluctuations about a gradually rising trend line in the last column of table 2. Table 3 shows how we can project a trajectory for the most likely foreign demand for U.S. wheat each year, on the basis of historical data. Differences between actual demand, and this projected trajectory of likely demand account for year-to-year fluctuations in the U.S. price of food. Table 3 shows how, in turn, these fluctuations can be traced back to fluctuations in food production in other countries, which in turn are largely the product of fluctuations in crop-growing weather. The second column gives the trend in world population, exclusive of the United States of America. The third column computes a likely trend in world per capita demand for wheat, exclusive of the United States, on the assumption that that trend is a simple linear function of gross world product each year. The fourth column gives world per capita likely what production, on the assumption that that trend is a simple linear function of year number.

The fifth column gives a likely trend in foreign demand for U.S. wheat, computed from world population multiplied by the difference between per capita wheat demand and production (from the previous two columns). The sixth column gives actual U.S. wheat exports. The difference between actual wheat exports, and the trend in likely foreign demand for U.S. wheat is in the seventh column. Prior to 1972, this difference was large, because prior to the great increase in U.S. imports of O.P.E.C. crude oil, it was not necessary for the United States to export vast quantities of agricultural commodities to balance up its international trade, and further, there was an insuficient market for U.S. wheat amongst nations able to pay for it. This market was created with the Nixon understandings with Moscow and Peking. After 1971, discrepancies between actual wheat exports and likely exports can be accounted for on the basis of fluctuations in the wheat harvests in world major wheat-growing countries, particularly the Soviet Union. Thus, the big surge in actual exports relative to likely expected exports in 1973 is attributable to a shortfall in Russian wheat production in 1972 (see table 6).

TABLE 3.—COMPUTATION OF LIKELY TREND IN FOREIGN DEMAND FOR U.S. WHEAT, AND DIFFERENCE BETWEEN THIS TREND AND ACTUAL U.S. WHEAT EXPORTS

Year	Non-U.S. world population (millions)	Per capita non-U.S. world wheat demand production (bushels)		In millions of bushels: Foreign demand for U.S. wheat	Actual U.S. wheat exports	Actual U.S. wheat exports less foreign demand
1967	3,225	3.25	2.99	839	761	−78
1968	3,286	3.31	3.03	920	544	−376
1969	3,362	3.37	3.06	1,042	606	−436
1970	3,430	3.41	3.09	1,098	741	−357
1971	3,502	3.44	3.13	1,085	610	−475
1972	3,576	3.49	3.16	1,180	1,135	−45
1973	3,648	3.49	3.19	1,094	1,217	123
1974	3,720	3.54	3.23	1,153	1,019	−134
1975	3,795	3.58	3.27	1,176	1,173	−3
1976	3,871	3.61	3.30	1,200	950	−250
1977	3,948	3.65	3.33	1,263	1,145	−118

At the beginning of this discussion, it was asserted that common sense indicates that low energy prices would encourage energy use, but discourage energy production. What does the evidence say? First, with respect to the effect of energy price on use within the United States, energy prices have never increased enough to have any discernable impact on use. As table 4 indicates, retail gasoline prices are actually lower now, relative to average spendable weekly earnings, than they were in 1965. To discover the likely impact of any significant energy price increases on U.S. energy use, we have to turn to comparative international data. However, to expose the effect of energy prices on use per capita, it is not adequate to simply use the price: we must use the price corrected for the ability to pay that price. Thus, in figure 3, a plot of gasoline use per capita as a function of price, there is only a slight relationship (the fitted line is based on the data for all countries). However, when the price of gasoline is expressed as a proportion of GNP per capita as in figure 4, a very striking dependence of use on price is revealed. These two graphs reveal an important point about U.S. energy policy: it is meaningless to increase energy prices by a factor of two, in the name of conservation, over a sequence of years in which average spendable earnings are increasing by a factor of three. This would actually increase the use of gasoline. There will be no real energy conservation in the United States until energy prices are allowed to increase at a faster rate than wages. Figure 4 also indicates how low U.S. energy prices are relative to those in other countries, including Sweden, which has a GNP per capita higher than in the United States. Clearly, the argument that higher energy prices would be inimical to economic growth needs examination.

TABLE 4.—INCREASE IN GASOLINE PRICES, RELATIVE TO THE INCREASE IN AVERAGE SPENDABLE WEEKLY EARNINGS

Year	Retail price index, regular and premium gasoline [1]	Average spendable weekly earnings, worker in private nonagricultural industry with 3 dependents [2]	Price of gasoline: Average earnings
1960	92.5	73.0	1.27
1965	94.9	86.3	1.10
1970	105.6	104.6	1.01
1971	106.3	112.4	.95
1972	107.6	121.1	.89
1973	118.1	127.4	.93
1974	159.9	134.4	1.19
1975	170.8	145.9	1.17
1976	177.9	156.5	1.14
1977	189.2	182.7	1.04

[1] From table 784, Statistical Abstracts of the United States for 1977.
[2] From table 666, Statistical Abstracts of the United States for 1977

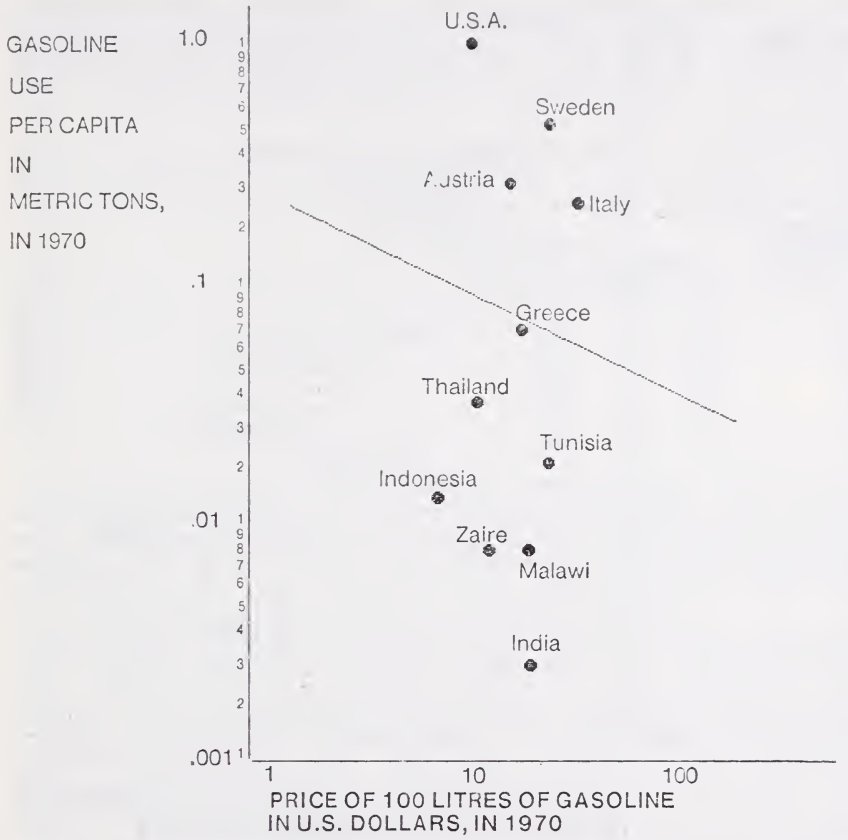


FIGURE 3.—The relation between gasoline price and use per capita: cross-sectiona analysis across countries. Based on statistics published by the Internationa Road Federation.

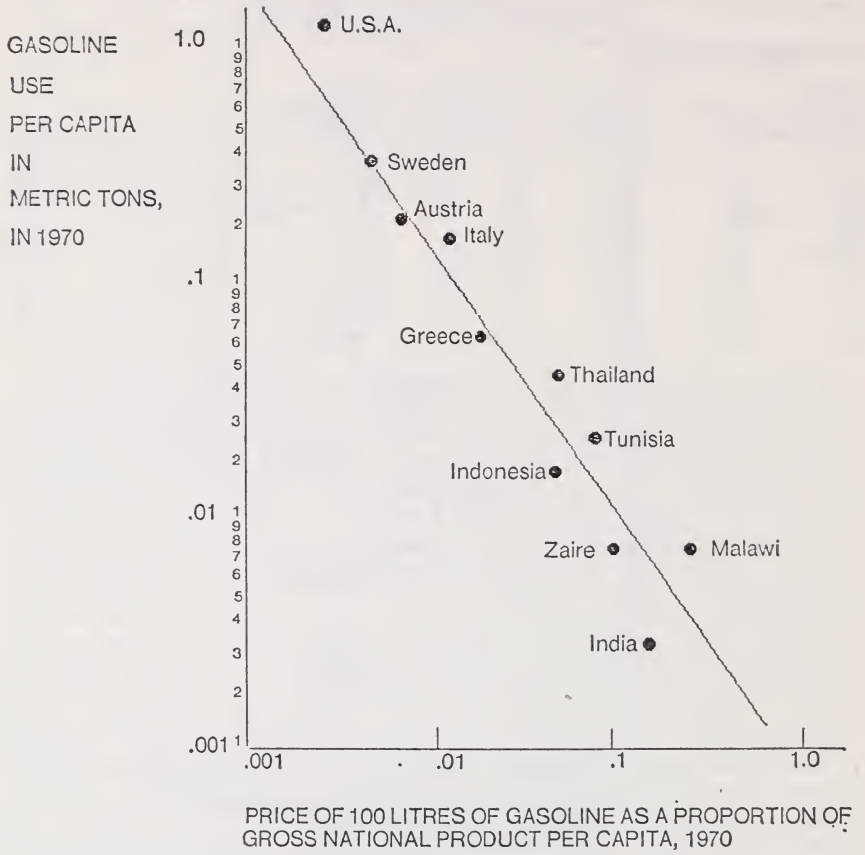


FIGURE 4.—The relation between energy price and use per capita, when price is corrected for ability to pay for gasoline.

Now what of the argument that low energy prices discourage production? First, we consider traditional sources of energy. In table 5 we see that while there has been a large increase in the price per barrel of crude oil at the well (column 2), this increase has been no more than that justified by the increase in cost per foot to drill for oil (column 3). Thus the ratio of price to cost is essentially the same in 1975 as it was in 1960. In other words, there is no more profit to drill for oil in the United States now than there was in 1960. So we simply do not know what would happen to the rate of oil production in the United States if the price of crude oil were to rise faster than drilling cost: No one has yet done the experiment to find out. However, table 5 does not reveal the complete story of the situation in which oil producers find themselves. Oil exploration and production will increasingly shift from onshore to offshore. While onshore costs of drilling for oil only increased by 2.03 times from 1960 to 1975, offshore costs increased by 2.58 times. In other words, the oil (and gas) industries will be forced to move to offshore sites as onshore sites are depleted, but the offshore exploration is far more capital intensive. Higher profitability for oil and gas producing companies can be regarded as an obscene and grossly inequitable redistribution of the capital in the United States;

but given the likely future of the industry, a far more reasonable interpretation is that the industry needs to be more profitable in order to raise the capital that will be necessary to fund the enormously expensive program of energy exploration and development that is on the way.

TABLE 5.—INCREASE IN THE AVERAGE PRICE OF A BARREL OF CRUDE OIL, RELATIVE TO THE AVERAGE COST PER FOOT TO DRILL FOR OIL

Year	Averate price per barrel of crude oil at the well	Average cost per foot to drill for oil	Average price of a barrel of crude oil relative to cost to drill 1 ft
1960	2.88	13.01	0.22
1965	2.86	13.44	.21
1970	3.18	18.84	.17
1972	3.39	20.76	.16
1973	3.89	22.50	.17
1974	6.74	28.93	.23
1975	7.67	36.99	.21

But there is another reason for raising energy prices. There is much talk about the need to develop new energy technologies, such as solar and wind power. However, these developments will be inhibited unless energy prices rise to a level at which they will be sufficiently attractive to risk capital. As long as energy prices are kept down by regulation, new energy technologies will be an uncertain investment.

Argument 2: The impact of cheap energy on U.S. economic stability. Many people will have noticed that within the last few years, the U.S. economy has developed an alarming tendency towards large, and unexpected economic fluctuations. In 1974, agricultural commodities prices were unusually high, and there was a tendency to inflation radiating outwards from the commodities sectors of the economy. But by 1977, there had been a great drop in the value of agricultural commodities. Farmers were going bankrupt, because they could not sell enough of their commodities, or get high enough prices to allow them to pay for their inputs. But also, there was a deterioration of the U.S. trade balance, the United States could not sell enough to pay for imported crude oil, U.S. dollars were piling up, unwanted, in many other countries, and the value of the dollar was dropping fast relative to a number of other currencies, particularly Japanese Yen, Swiss Francs, and German Marks. How did this come about?

If the Government keeps the price of energy down, thus stimulating massive oil imports, this means that the health of the U.S. economy becomes sensitive to two other factors. First, we must be able to produce enough goods for export to pay for the imported oil. But second, other countries must have the demand for enough of our exports for us to raise the cost of the crude oil bill from O.P.E.C. But in turn, the demand of other countries for our agricultural produce depends upon the ability of prospective customers for our food to produce that food themselves. This in turn, is dependent on their crop-growing weather. But particularly in some of the communist block countries which may import massive quantities of our food in certain years, their crop-growing weather is extraordinarily volatile, because their principal crop growing regions are in the center of massive land masses remote from the moderating effects of oceanic currents and wind systems.

Table 6 indicates just how variable crop production is in various countries. Notice, first, that the absolute amounts of food grown in other countries are very large relative to the total amount of food the United States can grow. Thus, the largest Soviet wheat crop was 89 percent higher than the largest U.S. wheat crop. But further, the crop production shortfalls in other countries can be very large relative to the largest crops the United States has ever produced. Thus, the decrease in the Soviet wheat crop from 1973 to 1975 was equal to 75 percent of the largest wheat crop the United States has ever produced. This means that if the United States, on average every year, must produce enough of a crop surplus to pay for imported crude oil, some years we will have produced way too much, and other years we will have produced way too little. Either of these eventualities throws a gigantic perturbation into the U.S. economy.

TABLE 6.—VARIABILITY IN PRODUCTION OF SOME OF MAJOR WORLD CROPS

[All figures in millions of metric tons]

Year	U.S.S.R.		Mainland China			India		United States	
	Wheat	Corn	Wheat	Rice	Corn	Wheat	Rice	Wheat	Corn
1975	66.2	7.3	41.0	116.3	33.1	24.1	74.2	58.1	147.3
1974	83.9	12.1	37.0	115.2	31.1	21.8	59.4	48.9	118.1
1973	109.8	13.4	36.0	112.0	30.4	24.7	66.1	46.4	143.4
1972	86.0	9.8	34.5	101.0	23.5	26.4	58.0	42.0	141.1
1971	98.7	9.5	32.0	104.0	-------	23.3	64.0	44.6	140.8
1970	99.5	10.3	-------	100.0	-------	20.1	63.7	37.5	104.4
1969	79.9	13.2	27.0	91.0	-------	18.7	60.7	39.7	116.3
1968	93.4	8.6	25.7	92.0	-------	16.5	59.7	42.8	111.2
1967	77.3	9.1	25.7	88.0	-------	11.5	47.7	41.5	119.9
Difference in production between most and least productive year	43.6	6.1	15.3	28.3	9.6	14.9	26.5	20.6	42.9

Table 7 suggests some of the kinds of perturbations that can be introduced into the U.S. economy by various combinations of crop-growing weather conditions throughout the world. Clearly, by keeping energy prices low and thus stimulating massive energy importation and massive food export, Congress makes the U.S. economy very sensitive to violent short-term economic fluctuations triggered by crop-growing weather in other countries, particularly Russia.

Of course, these violent economic fluctuations produce some utterly unexpected consequences. Many U.S. corporations have recently been bedevilled with foreign exchange currency translation losses. These losses occur when a company sells a product in the U.S. imported from elsewhere, but then has to pay the producer when the U.S. currency has dropped in value relative to the currency in which final payment is made. In effect, the U.S. corporation is trapped into selling cheap and buying dear, due to circumstances completely beyond its control. These circumstances are changes in the rate at which the U.S. dollar is dropping in value relative to other currencies, produced by changes in the rate at which we are exporting commodities to pay for imported crude oil; the ultimate causes are changes in the amount of crop shortfall produced in other countries in response to changes in their crop-growing weather. Of course, this crop-growing weather can be neither predicted nor managed. Thus by keeping energy prices down, Congress and the White House are turning the management of U.S.

enterprises into a vast game of chance. This is true for an enormous diversity of activities, including Exxon, the farm sector, the importer of European sporting goods, or of German stained glass.

TABLE 7.—IMPACT OF WEATHER ON ECONOMIC SCENARIOS FOR THE UNITED STATES

Crop-growing weather in United States	Crop-growing weather in countries importing U.S. crops	U.S. crop exports	U.S. domestic commodity stocks	U.S. commodity price inflation	Value of U.S. dollar relative to other currencies	Tendency to depression radiating outward from agriculture	Approximate probability of this scenario
Good	Good	High	Very high	Little	Dropping	High	0.55.
Good	Bad	Very high	Very low	Serious	Stabilizing	None	0.36.
Bad	Good	Very low	Low	Serious	Dropping	Moderate	0.01.
Bad	Bad	Low	Extremely low	Very serious	Stabilizing	Moderate	0.08.

Conclusion: Congress, by keeping energy prices so low as to encourage massive importation of crude oil, makes the U.S. economy very sensitive to violent economic fluctuations between inflation and depression.

Argument 3: The impact of cheap U.S. energy on the world economy. In years when the United States cannot export enough food to pay for imported crude oil, U.S. dollars accumulate in other countries because they cannot buy enough from us to use up all the dollars we have spent buying the crude oil. (This is an oversimplification of the situation, but in essence it is correct. Complications occur, as when Saudi Arabia sells unwanted U.S. dollars for gold, and the dollars are used, ultimately to purchase U.S. wheat). When these dollars accumulate, their value drops relative to the value of other currencies. This, in turn measn that a Volkswagon, Toyota, Sony, Rolls Royce jet engine or A300B airbus costs more in the United States. That, in turn means that all other factors remaining constant, we would be less likely to buy the foreign product. That is serious, because many foreign economies are more dependent on export markets than the United States, because their national populations are not large enough to give them significant and competitive economies of scale in manufacturing. Thus, enough of a drop in U.S. purchases of German, Japanese and other products could lead to significant slowdowns in their economies, and ultimately, a significant slowdown in the world ecomomy, including the U.S. economy. In short, cheap energy in the United States has implications which go far beyond the internal dynamics of our own economy. We cannot, on the one hand, expect Germany and Japan to keep the world from sliding into a new recession, yet on the other hand adopt an energy price policy which makes it impossible for them to sell enough to us to prevent that from happening. Our failure to grasp this is the root cause of a lot of the criticisms of our economic management so frequently expressed by foreign business and Government leaders and reported in the Wall Street Journal and elsewhere.

Argument 4: The impact ofc heap U.S. energy on resource substitution. When Congress continually votes to keep energy prices low, but to allow the minimum wage to rise, they are simply voting for a substitution of the cheap energy for expensive labor. In turn, this means they are voting for all the other phenomena that accompany that substitution: high rates of unemployment and crime, high costs for unemployment insurance and police protection, high costs of operating Government, an inefficient economy and a low rate of economic growth. None of this is theory: Each step in the implied

arguments can be demonstrated by statistical analysis of available data. Thus, in making comparisons between countries, we find that high crime rates accompany cheap energy.

Argument 5: Cheap energy and the survival of the United States. Normally, as the real cost of producing petroleum increased, this would be converted into a signal to the marketplace, in the form of higher retail prices. That signal, in turn, would have several effects, besides conservation. One effect would be to intensify the search for existing energy sources (oil, gas, coal). Another effect would be to stimulate research and development for new energy sources and technologies. However, by keeping energy prices artificially low, Congress and the White House prevent such a message from being flashed to the marketplace. That, in turn means, that when the United States begins to run short of conventional sources of cheap energy, there will be a mad scramble to develop and find energy sources for which the search should now be underway. But can we make up the lost time under crisis conditions? This, in turn raises the question as to how long it takes to get new energy technologies in place. In fact, as figure 5 shows, it has taken a very long time indeed to get new technologies in place. The times it took before coal, oil and gas supplied 30 percent of U.S. energy consumption were 72, 78 and 69 years, respectively. So the times were not only remarkably long, they were remarkably similar. The reason is that the rate at which a national population of energy generating plants of a particular type can be built up is limited by a thermodynamic constraint. If the population builds too rapidly, too high a proportion of the entire population has just been constructed or is under construction. In that case, there would be no net energy or money output from the entire national population of plants. Thus, a problem with a national policy of keeping energy prices down is that we might get caught in a "systems trap" in 10 or 20 years: We might get trapped into trying to build new energy generating systems so rapidly that there was no net energy output from the construction process at all. To illustrate, when the gross energy output from the entire national population of nuclear plants grows at 24 percent or more, there is no net energy output at all. To 1977, that gross energy grew at 38 percent: one reason why Project Independence became Project Dependence.

ENERGY CONSUMPTION BY CATEGORY
AS A PERCENTAGE OF TOTAL U.S. ENERGY CONSUMPTION

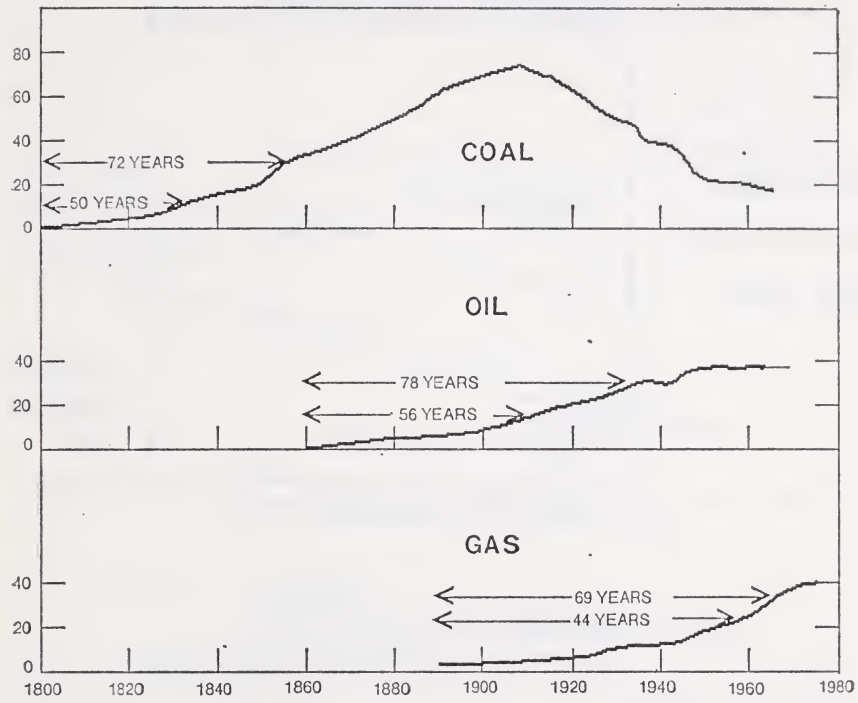


FIGURE 5.—The time it took to have each of coal, oil and gas supply 10, and 30 percent of national energy consumption.

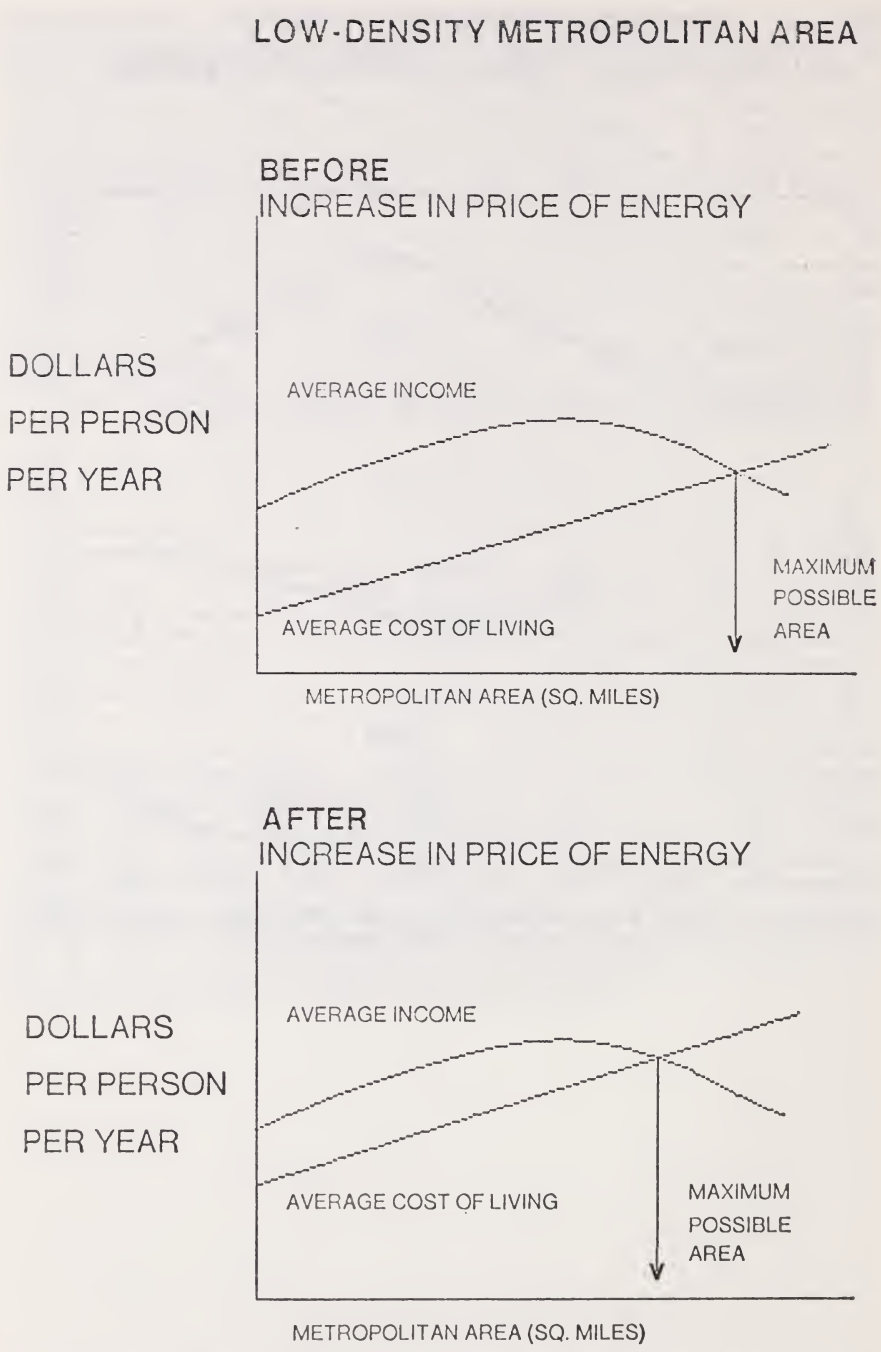
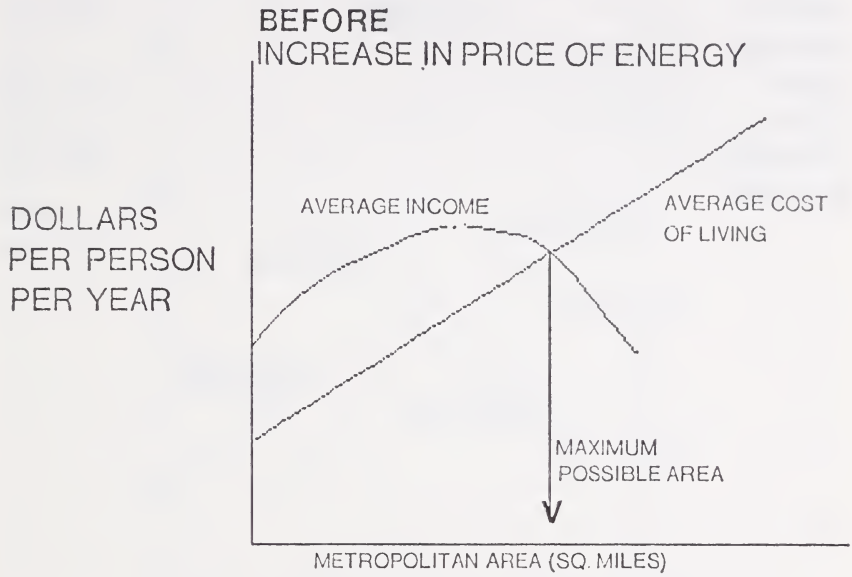


FIGURE 6–6a.—A theory of the relation between average income, average cost of living, city density and city area. Note that these relations determine the area of a city which is economically viable; also note that this maximum viable economic area shrinks in response to increasing energy prices.

HIGH-DENSITY METROPOLITAN AREA



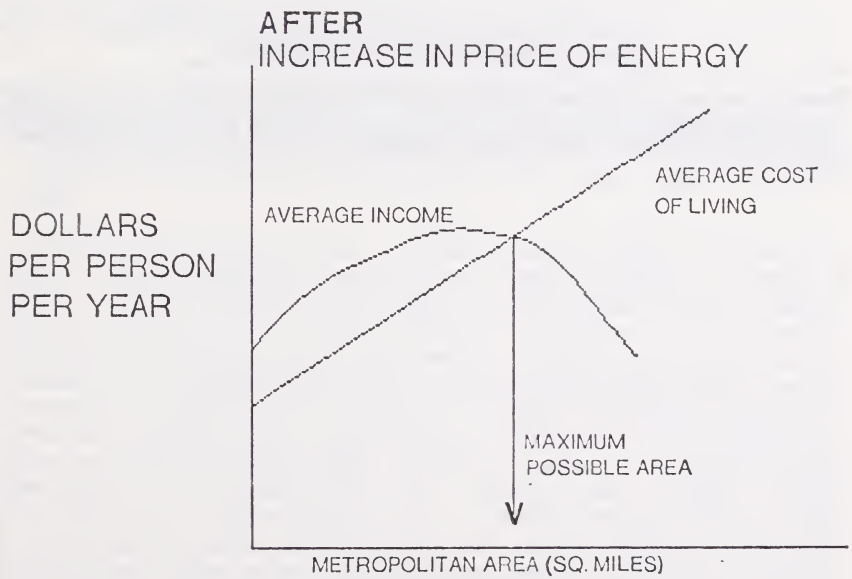


FIGURE 6a

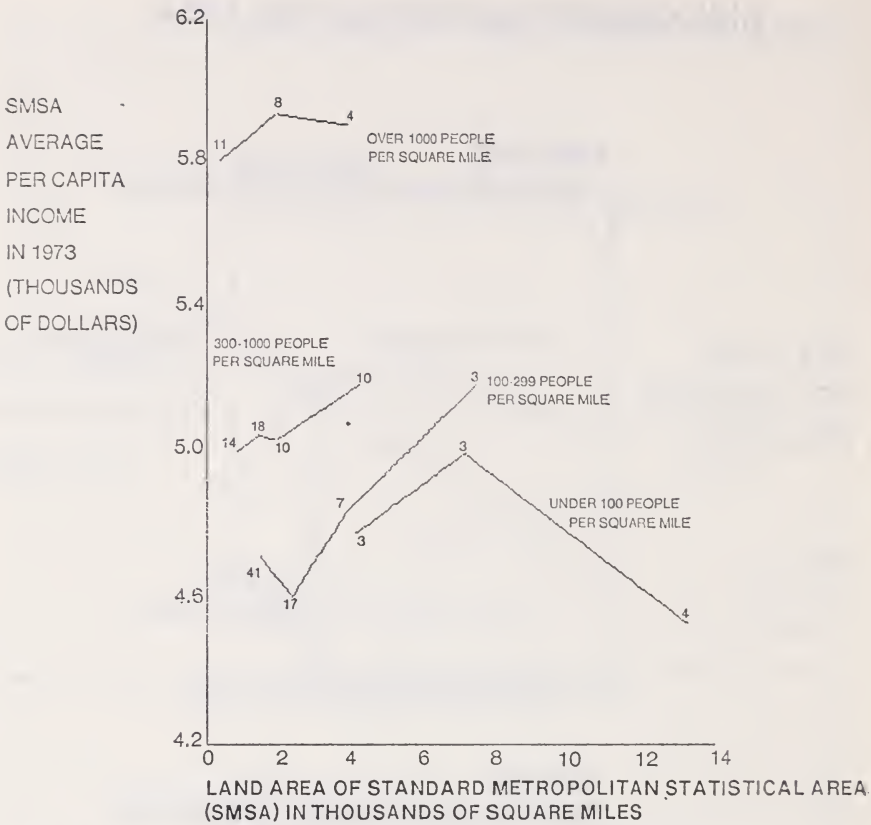


FIGURE 7.—Test of the notion that average incomes are related to city densities and areas, using Bureau of the Census data. Numbers above the lines indicate the number of metropolitan areas averaged to make each point in each line.

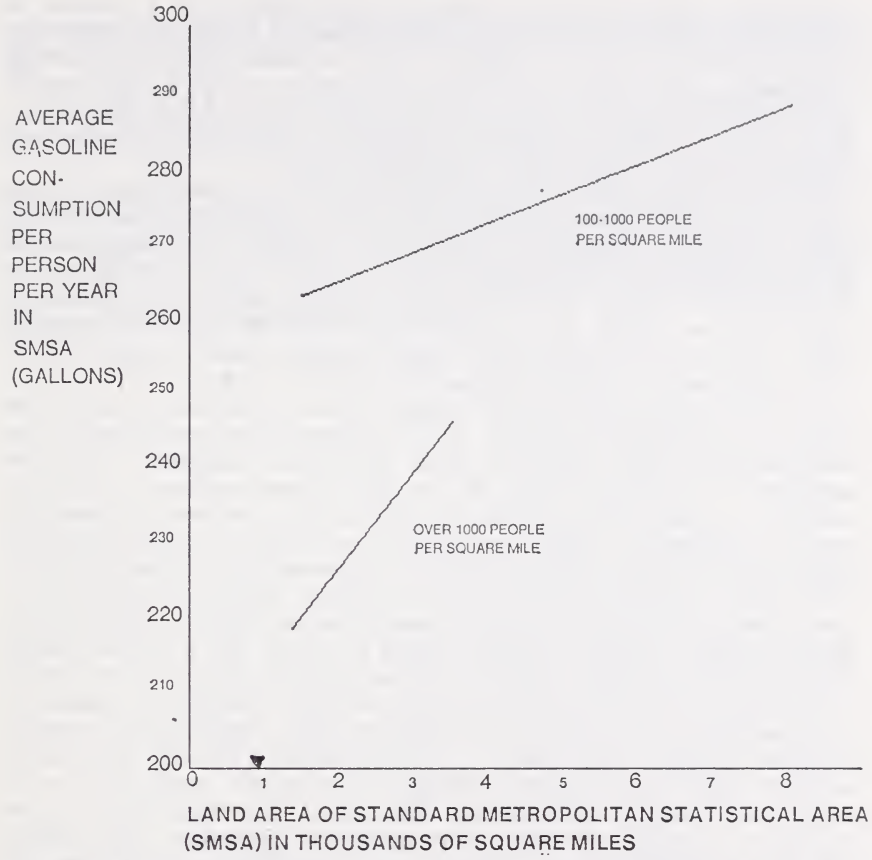


FIGURE 8.—Test of the notion that average living cost is affected by city density and area, using data from the Census of Retail Trade. The lines are drawn through points obtained by averaging data from a great many metropolitan areas.

Argument 6: Cheap energy and the spatial design of American society. Cheap gasoline is encouraging American cities to develop a pattern of urban sprawl which builds a tremendous hidden transportation overhead cost into all activities. But further, a great deal of the Nation's capital is being invested in a physical plant which will be difficult to maintain when the price of gasoline begins rising rapidly in response to worldwide increases in the cost of obtaining energy, an inevitable development once all cheap O.P.E.C. crude oil is depleted, in the late 1980's or early 1990's. Figure 6 presents a graphical theory showing how, in either high or low density cities, average cost of living rises with increased city area, whereas average incomes drop at very high city areas. Also, incomes rise as a function of city density, for any given urban area. The maximum possible size that a city can be is determined by the area at which the income and cost of living lines cross. For cities of all densities, this maximum possible area must drop when gasoline price increases drive up the cost of living. Clearly, unless gasoline prices are allowed to rise faster than the average wage

very shortly, the U.S. cities are going to get locked into a pattern of continuing sprawl that will be a terrible financial burden for everyone, once the inevitable future gasoline price increases do occur. Putting it differently, our cities are being encouraged to evolve in response to energy prices which are not an accurate reflection of the state of the world, but an artificial reflection created by interference in the free marketplace by Congress and the White House.

Figures 7 and 8, based on analysis of data from the Bureau of Census, census of population and of retail trade in gasoline, show that the theory graphed in figure 6 does in fact describe the situation. In short, the federal government is now in the ironical position of encouraging U.S. cities to evolve rapidly in the fashion of dinosaurs, which became extinct because they had adapted to an environment which did not last. Further, this inappropriate spatial design already is having a large, but veiled impact on the U.S. economy. The hidden transportation overhead on all transportation of goods and passengers affects our ability to compete in the international marketplace for manufactured goods with the other developed countries. This phenomenon is revealed when we conduct cross-sectional statistical analyses to discover the factors that determine the rate of growth of various economies. When we do this we discover that population density shows up as a beneficial factor in promoting economic growth. What this actually reflects is not a beneficial impact of high population density, but rather of hidden transportation efficiency and lowered transportation systems overhead when a society has a spatial design which promotes energy efficiency in passenger and goods movement. This efficiency is associated with short average distances for passenger and goods trips, both within and between cities. Particularly as transportation energy costs rise, the United States will only be able to compete with other nations manufacturing goods competitive with ours if our transportation energy efficiency is increased. One way to do this is to make our cities more compact. Otherwise, this Nation will have stumbled into a "systems trap" by failing to look ahead to the implications for the spatial design of society of higher future energy prices.

There is a simple solution to all six of these problems. The United States currently has an overall policy of making low energy price a basic national policy, then allowing policy in every other policy area to follow from that. Thus, national agricultural policy, foreign policy, our strategies of international agricultural development, military policy and all other policies are determined by our commitment to cheap energy, no matter how much mischief results. Thus, for example, instead of shipping wheat, corn, soybeans and rice to other countries so we can raise the money we need to pay for imported crude oil, it would make far more sense for many other countries, particularly in the tropics, to shift from the growing of cash crops for export to us to growing wheat, corn, rice and soybeans. We would not have to export commodities to them if energy prices were high enough so that we could be self-sufficient in energy. Further, if countries were all more independent in agriculture, thus eliminating a lot of unnecessary agricultural shipments across the oceans, the whole world would be more energy-efficient. It would seem to be worthwhile to become energy-efficient now, voluntarily, through

wise planning, rather than waiting a few decades and having efficient use of energy forced on us, with some trauma, as worldwide depletion forces higher prices.

It would make far more sense to have national agricultural policy be the basic policy from which all other policies flowed. In that case, we would determine a reasonable price to farmers for their produce, and a reasonable price for consumers to pay for food, and let national energy policy be determined by the free play of market forces, given national agricultural policy. The problem with present policy is that it has produced economic distortions simultaneously in farming, coal, oil and gas industries. This is, on the face of it, a remarkable state of affairs. Surely we can do much better.

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